Citizen Scientists Assist Cylindrospermopsin Monitoring in Missouri Reservoirs

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The Missouri Department of Natural Resources

Missouri Department of Health and Senior Services

Region V11, US Environmental Protection Agency, through the Missouri Department of Natural Resources, has provided partial funding for this project under Section 319 of the Clean Water Act

SECTIONS HOME SEARCH

The New York Times

Trump's Unreleased Taxes Threaten Yet Another Campaign Promise

Court Decisions Force Arkansas to Halt Execution

U.S.

Reeking, Oozing Algae Closes South Florida Beaches

By LES NEUHAUS JULY 1, 2006

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Toledo's tap water undrinkable for a second day; test results delayed

Toledo, Ohio, residents stock up on bottled water after tests found a toxin in water at a treatment plant. (Associated Press)

By James Queally - Contact Reporter

In Case You Missed I

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As Climate Warms, Algae Blooms In Drinking Water Supplies

September 3, 2018 4:29 PM ET

Heard on All Things Considered

DIRK VANDERHART

FROM

POLLUTION

Blue-green toxic algae invade Florida river

By James Rogers | Fox News

Green algae is seen in the St. Lucie River near Phipps Park on July 12, 2018 in Stuart, Florida. Water releases which carry

LIVING

Toxic algae blooms becoming more common across US

By Associated Press

June 22, 2018 | 4:02pm

Toxic algae bloom found in Ohio River

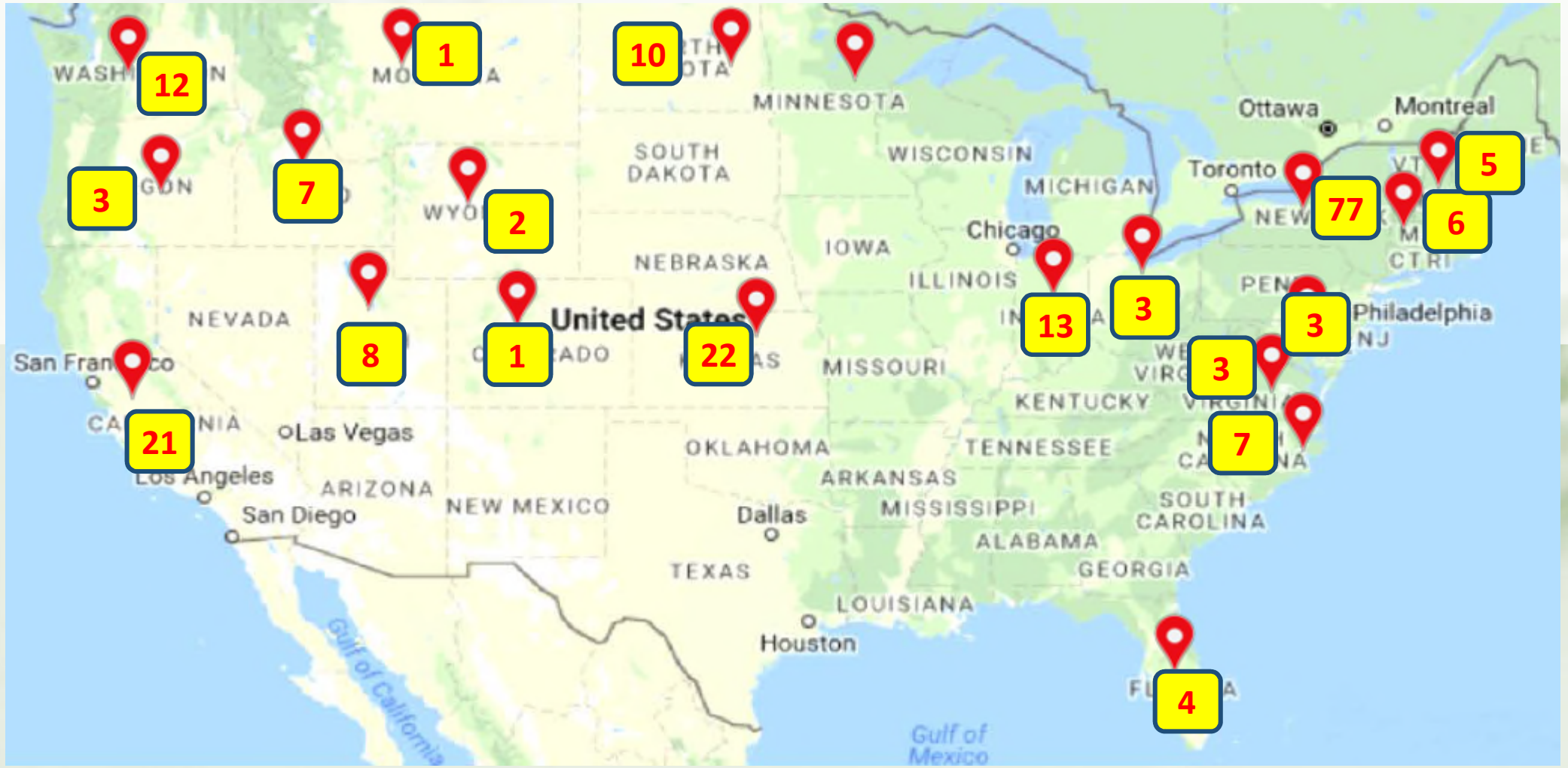
▲ HIDE CAPTION

file photo shows algae near the City of Toledo water intake crib, in Lake Erie, about 2.5 miles off the shore of Curtice, Ohio. - Ilana N.

photo

Toxic algae have reached the Ohio River. A bloom of microcystis, a blue green algae capable of producing liver and nerve toxins that can sicken people and kill pets, has formed in the Ohio River near Belmont County

USA HABS: September, 2018 (non-comprehensive list)



The map includes blooms, cautions, warnings, public health advisories, closings and detections over the State's threshold, due to the presence of algae, toxins or both. This is not a comprehensive list, and many blooms may have not been reported.

From the cyanoHABs newsletter. Email: epacyanohabs@epa.gov to sign up, or Google "EPA cyanohabs newsletter"

EPA Cyanotoxin Advisory Levels

Cyanotoxin	Drinking: Bottle-fed infants and preschoolers	Drinking: School-age children and adults	Recreational exposure
Microcystin	0.3 µg/L	1.6 µg/L	4 µg/L
Cylindrospermopsin	0.7 µg/L	3.0 µg/L	8 µg/L

Cylindrospermopsin advisory levels are approximately double those of microcystin

Data Sources

LAKES of MISSOURI VOLUNTEER PROGRAM

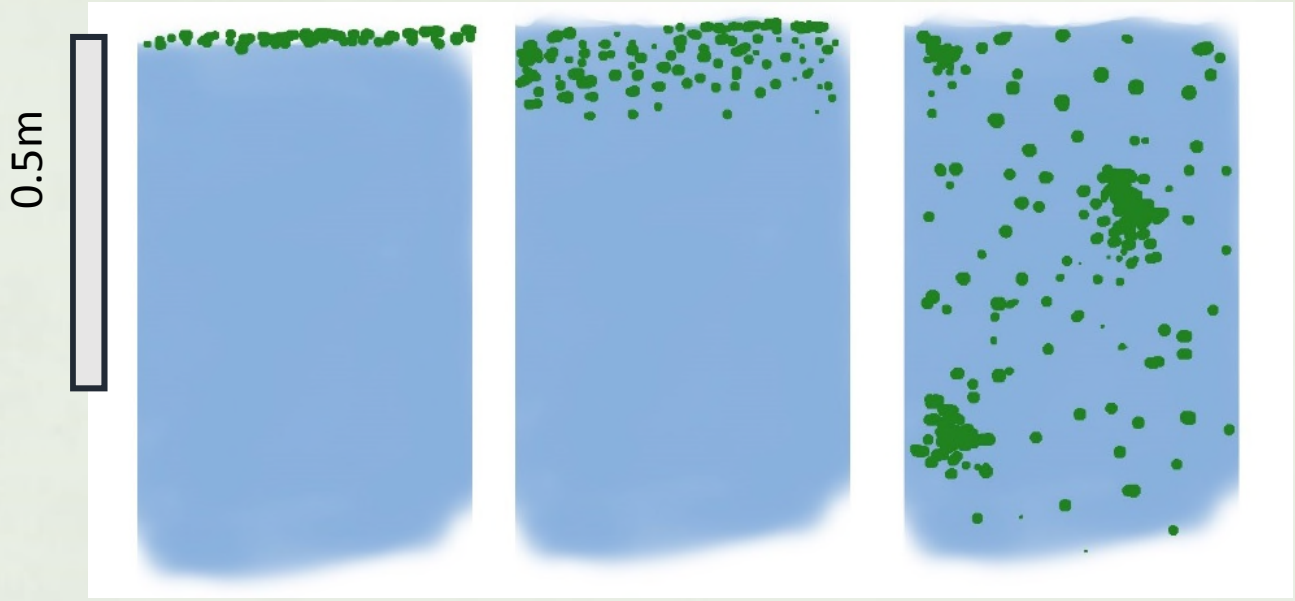
STATEWIDE LAKE ASSESSMENT

Data Caveats

- Merging of 2 reservoir datasets
    - **Lab monitoring** (Statewide Lake Assessment Project): Mid May through late August
    - **Volunteer Monitoring** (Lakes of Missouri Volunteer Program): Late April through mid September
- Volunteer data not always from dam site; Some reservoirs represented by multiple monitoring sites

Sample Collection

- Largely ambient (vs. targeted) monitoring
- Defined location, typically near dam
- 0.5 meter integrated sample

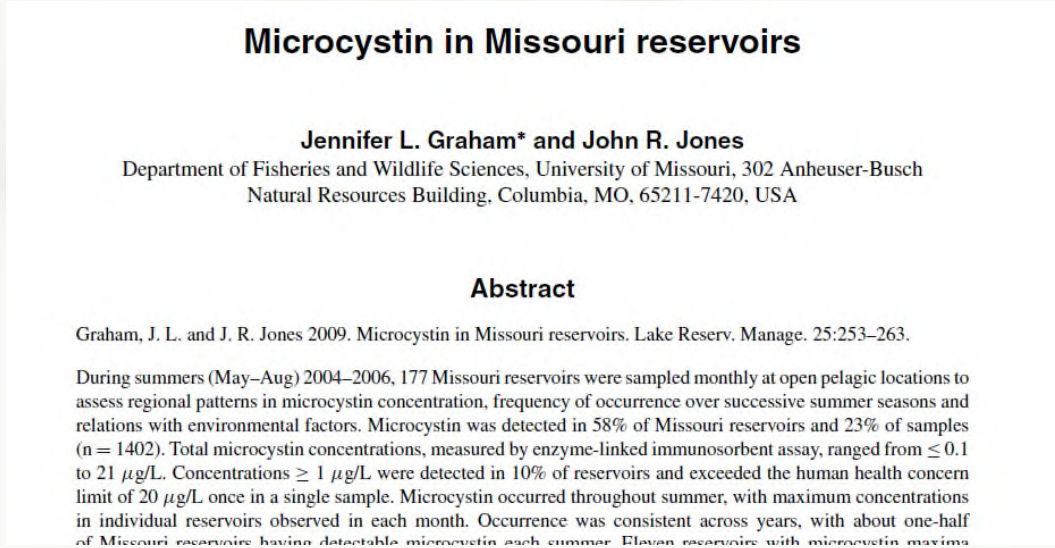


Questions

- How prevalent is cylindrospermopsin in Missouri?
- Are cylindrospermopsin values/occurrences changing over time?
- Does cylindrospermopsin presence/concentration vary with trophic state?

Cylindrospermopsin Distribution

Previous Cylindrospermopsin Observations in Missouri Reservoirs



Microcystin in Missouri reservoirs

Jennifer L. Graham* and John R. Jones
Department of Fisheries and Wildlife Sciences, University of Missouri, 302 Anheuser-Busch Natural Resources Building, Columbia, MO, 65211-7420, USA

Abstract

Graham, J. L. and J. R. Jones 2009. Microcystin in Missouri reservoirs. Lake Reserv. Manage. 25:253–263.

During summers (May–Aug) 2004–2006, 177 Missouri reservoirs were sampled monthly at open pelagic locations to assess regional patterns in microcystin concentration, frequency of occurrence over successive summer seasons and relations with environmental factors. Microcystin was detected in 58% of Missouri reservoirs and 23% of samples (n = 1402). Total microcystin concentrations, measured by enzyme-linked immunosorbent assay, ranged from ≤ 0.1 to 21 μg/L. Concentrations ≥ 1 μg/L were detected in 10% of reservoirs and exceeded the human health concern limit of 20 μg/L once in a single sample. Microcystin occurred throughout summer, with maximum concentrations in individual reservoirs observed in each month. Occurrence was consistent across years, with about one-half of Missouri reservoirs having detectable microcystin each summer. Eleven reservoirs with microcystin maxima

Cyanotoxins in inland lakes of the United States: Occurrence and potential recreational health risks in the EPA National Lakes Assessment 2007

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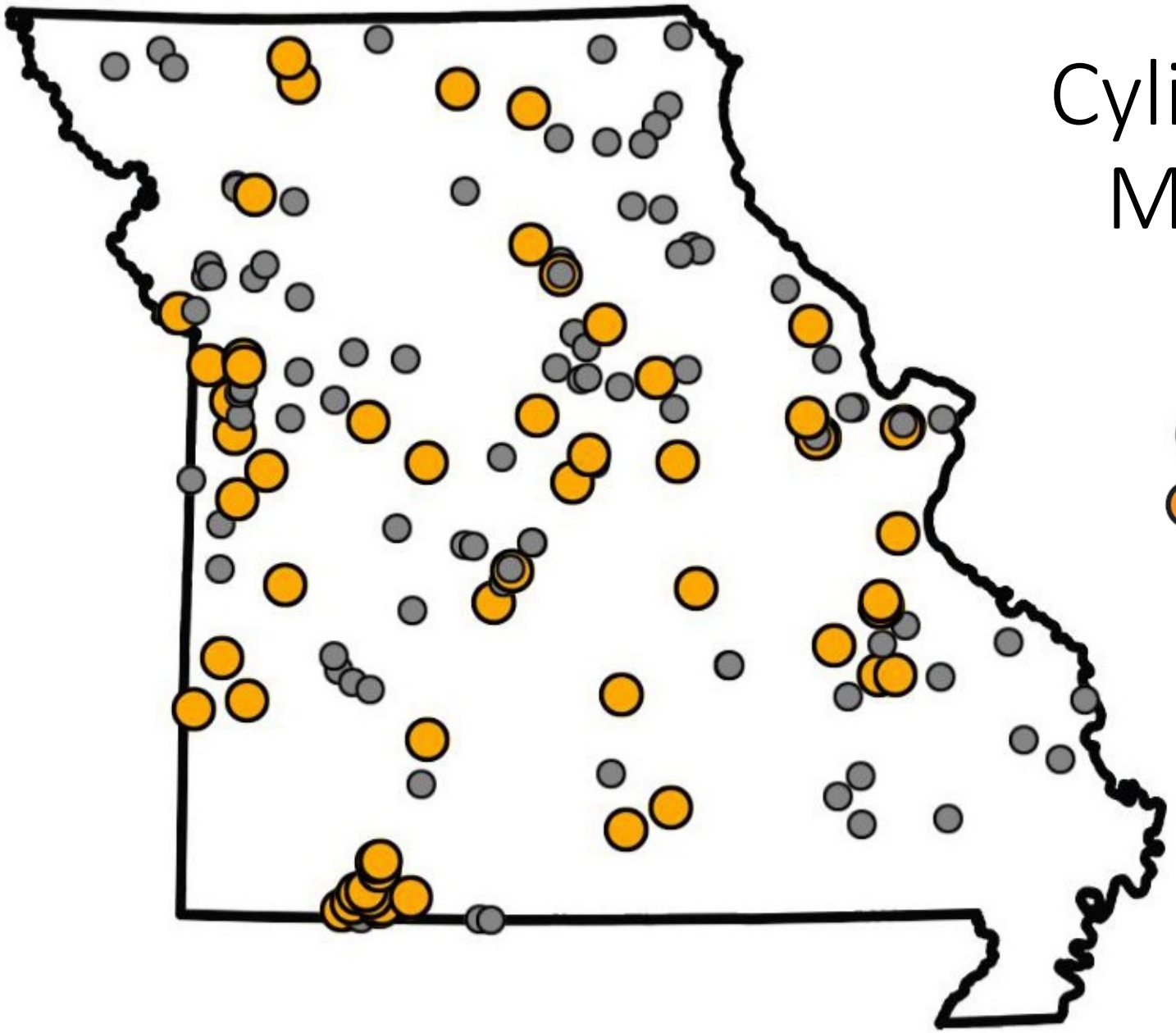
ABSTRACT

A large nation-wide survey of cyanotoxins (1161 lakes) in the United States (U.S.) was conducted during the EPA National Lakes Assessment 2007. Cyanotoxin data were compared with cyanobacteria abundance- and chlorophyll-based World Health Organization (WHO) thresholds and mouse toxicity data to evaluate potential recreational risks. Cylindrospermopsins, microcystins, and saxitoxins were

- 36 reservoirs, 1 sample each (n=36)
- Few cylindrospermopsin detections, all <1 µg/L

- 24 reservoirs, 1-2 samples each (n=28)
- 6 cylindrospermopsin detections, 2 ≥ 1 µg/L



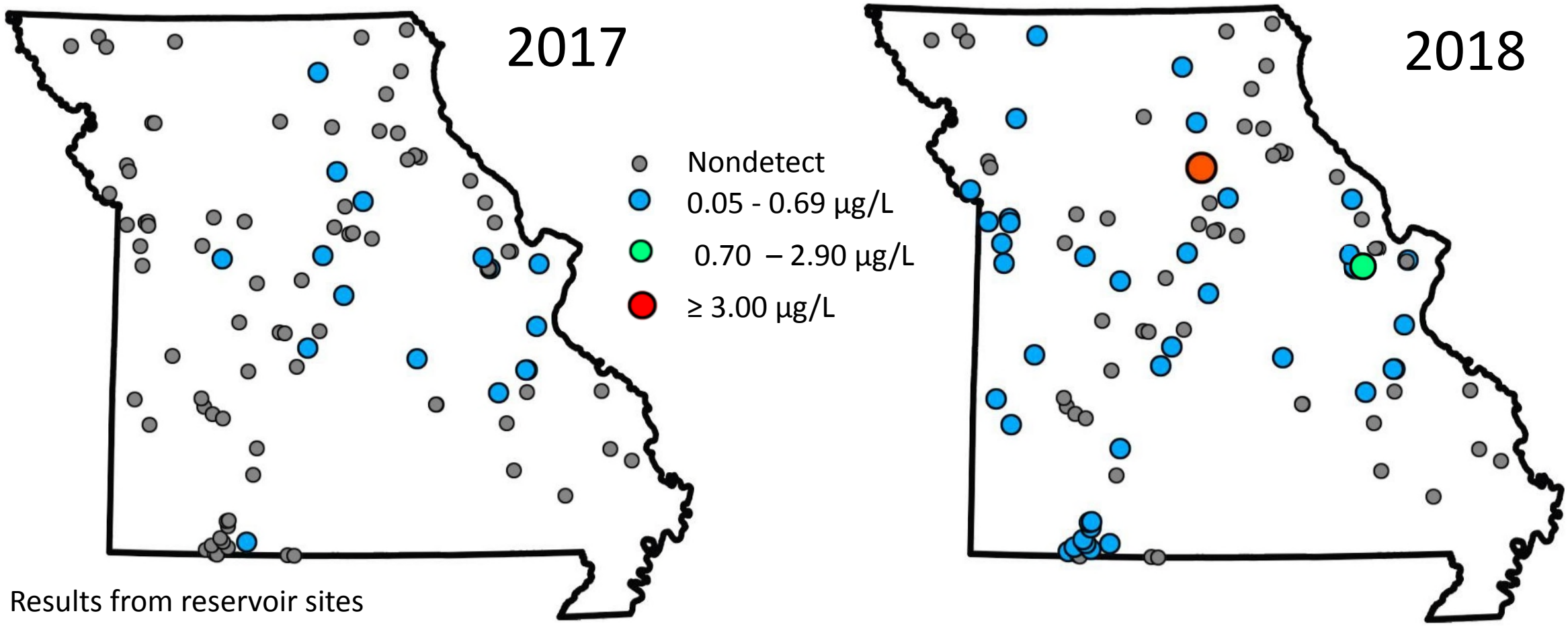
Cylindrospermopsin in Missouri Reservoirs 2017 and 2018

	n
Samples	1225
Reservoirs	128
Reservoir sites	154

38% of sample sites had cylindrospermopsin in at least 1 sample

2017 vs 2018

Maximum Cylindrospermopsin Concentrations



Results from reservoir sites sampled both seasons

Percentage of Monitoring Sites with Measurable toxins

Toxin	2017 n=99	2018 n=99
Cylindrospermopsin	16%	41%
Microcystin	83%	61%

Results from reservoir sites sampled both seasons

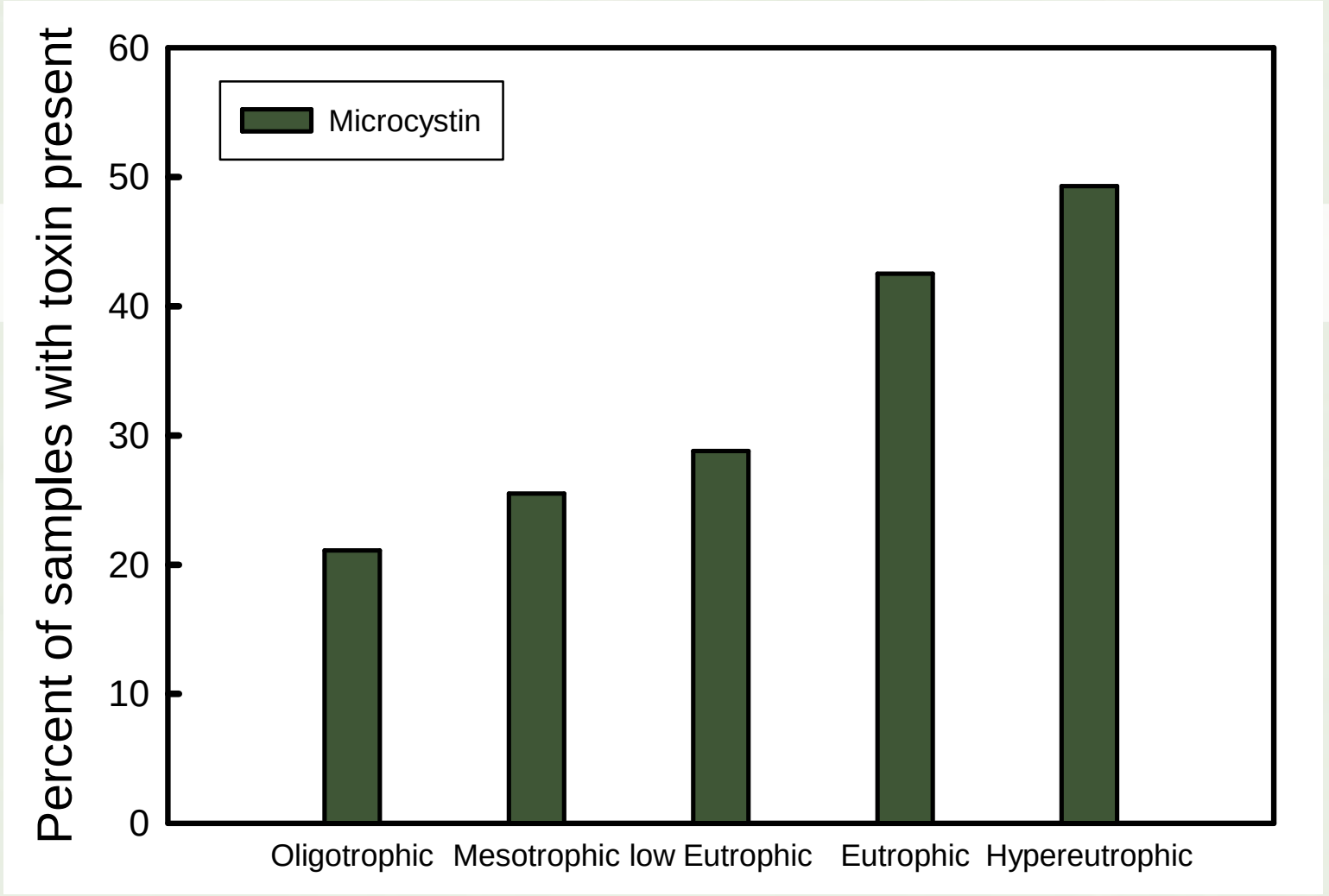
Trophic State Examination

Trophic State	Percent of data (n=972)	CHL Trophic Cut point
Oligotrophic	11%	< 3 µg/L
Mesotrophic	19%	3-9 µg/L
Lower Eutrophic	29%	9-18 µg/L
Eutrophic	26%	18-40 µg/L
Hypereutrophic	15%	≥40 µg/L

Results from reservoir sites sampled both seasons

Trophic State Examination

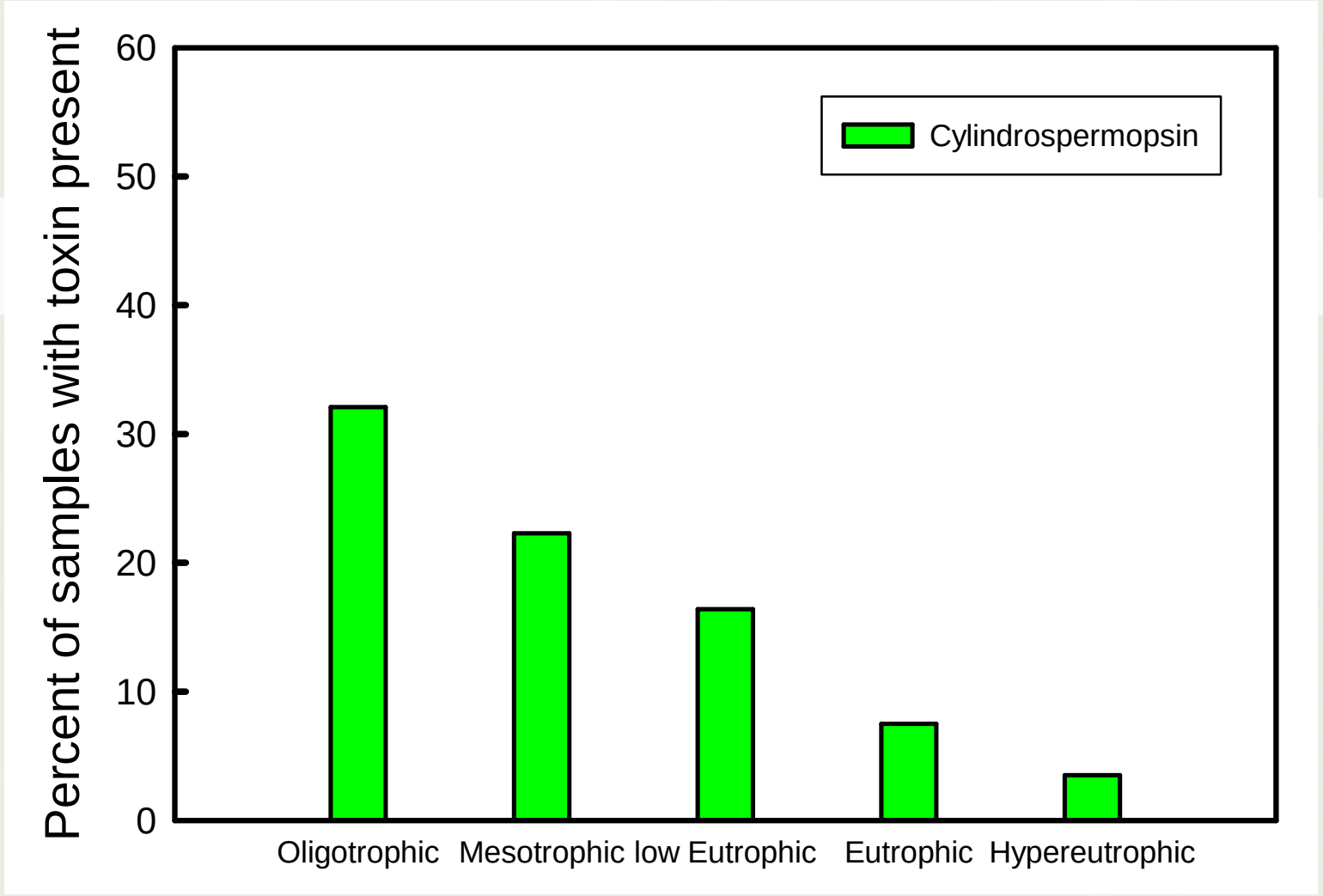
Microcystin



Results from reservoir sites sampled both seasons

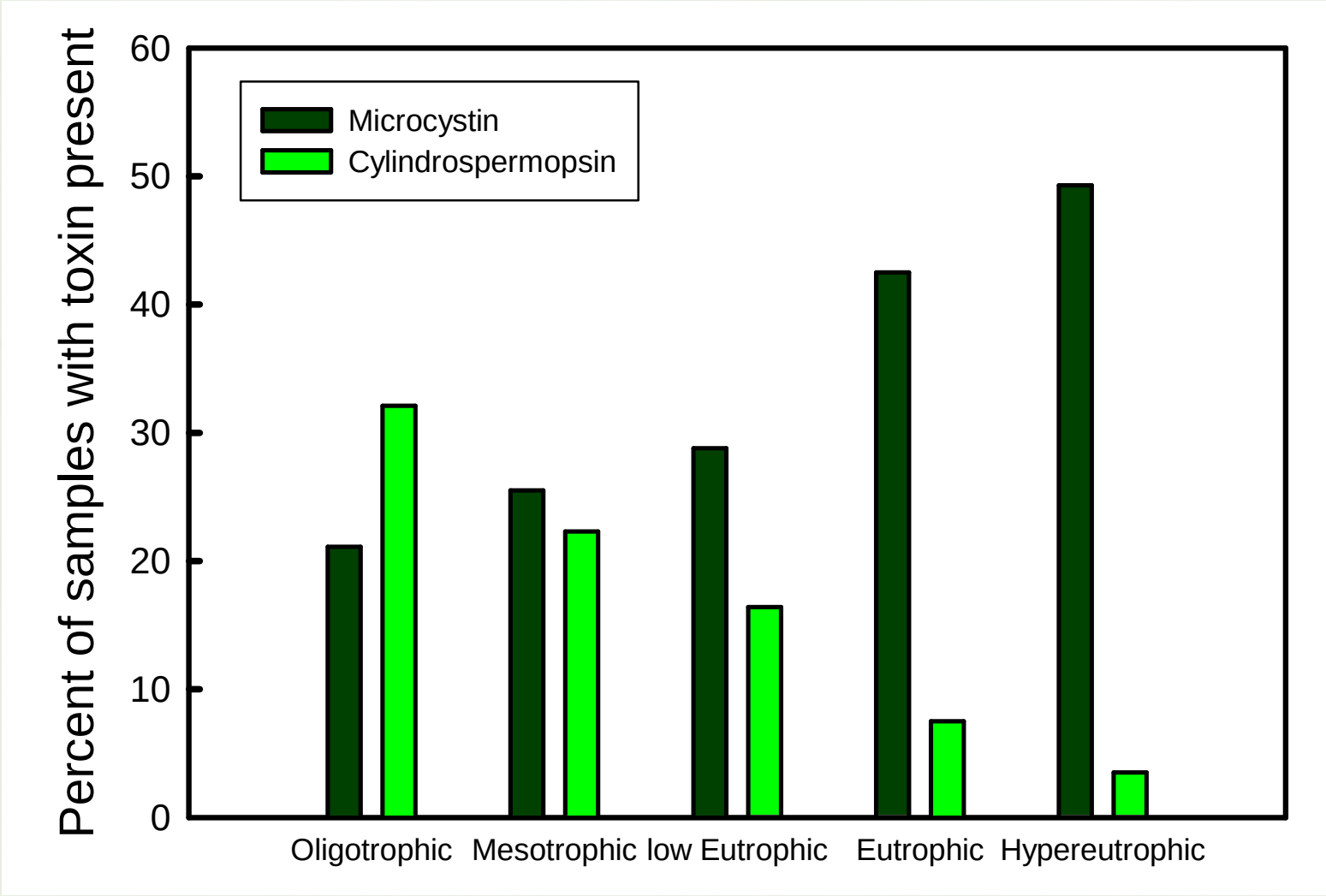
Trophic State Examination

Cylindrospermopsin



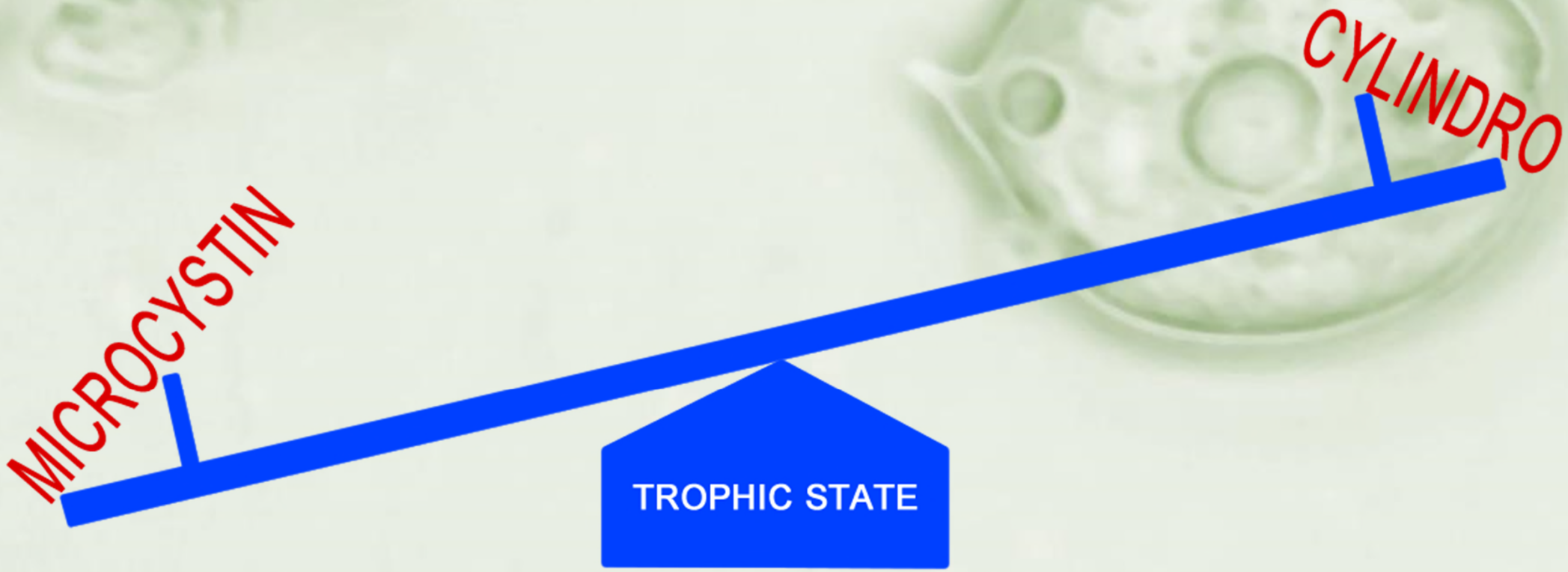
Results from reservoir sites sampled both seasons

Trophic State Examination



Results from reservoir sites sampled both seasons

At the cross-system scale, the data indicate that microcystin and cylindrospermopsin respond inversely (or at least differently) to chlorophyll.

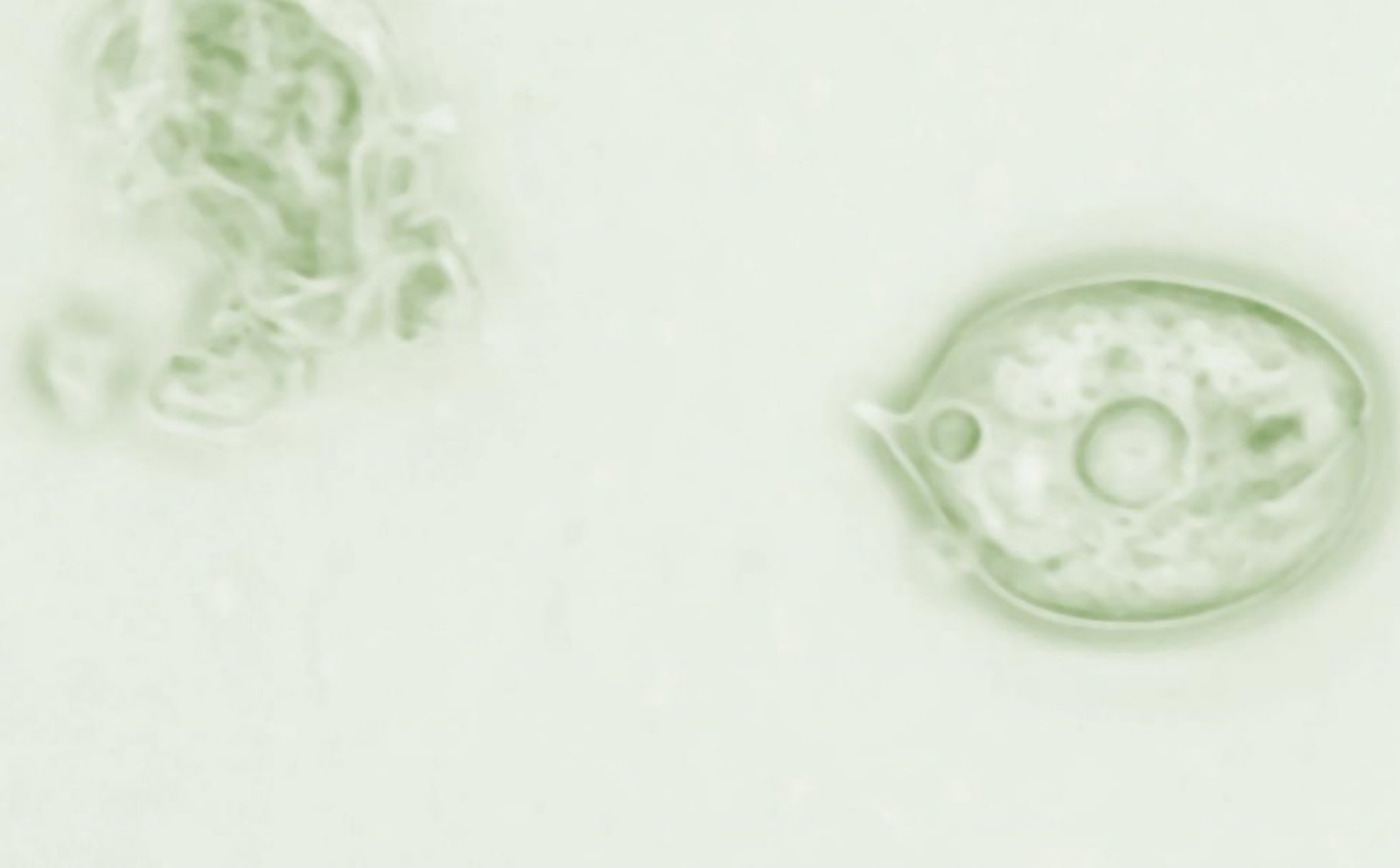


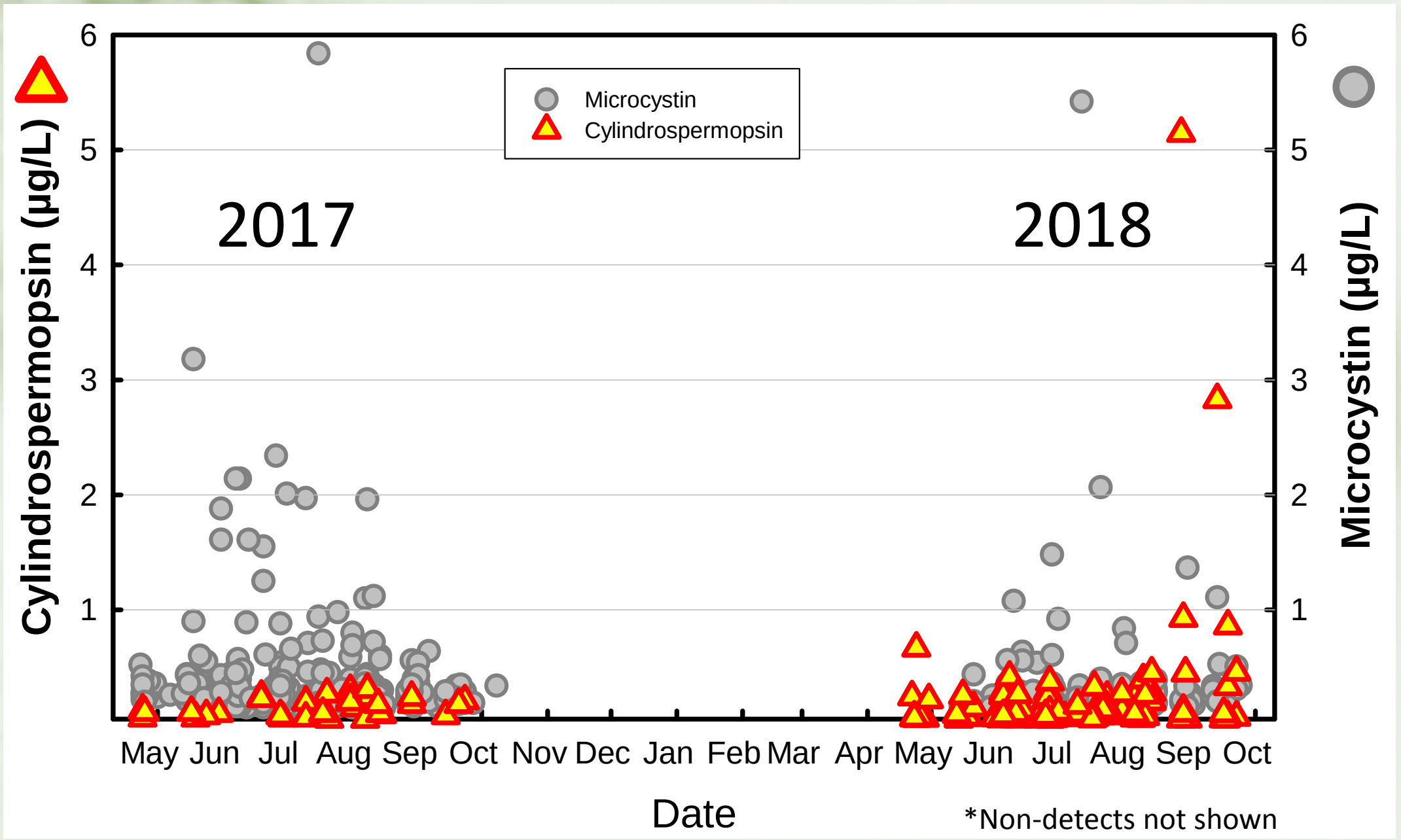
Questions

- How prevalent is cylindrospermopsin in Missouri?
  - 41% of 2018 monitoring sites
- Are cylindrospermopsin values/occurrences changing over time?
  - More detects in 2018
- Does cylindrospermopsin presence/concentration vary with trophic state?
  - Yes, but differently than Microcystin

Thank you!

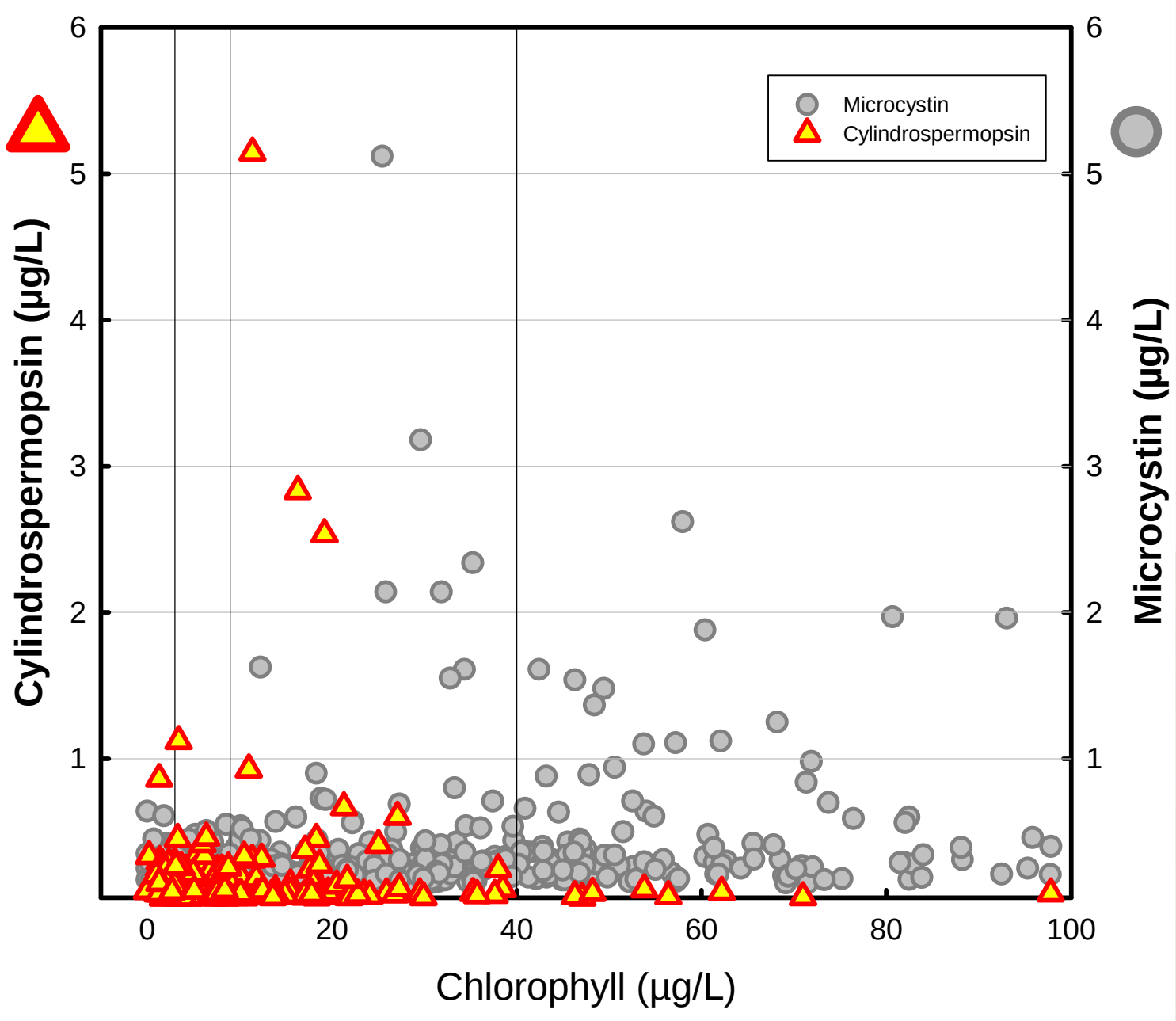
Citizen Scientists with the Lakes of Missouri Volunteer Program
Employees of MU Limnology Laboratory
Missouri Department of Natural Resources
U.S. Environmental Protection Agency
Missouri Department of Health and Senior Services




Microcystin
Cylindrospermopsin
2017
2018
Cylindrospermopsin (µg/L)
Microcystin (µg/L)
6
5
4
3
2
1
May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct
Date
*Non-detects not shown

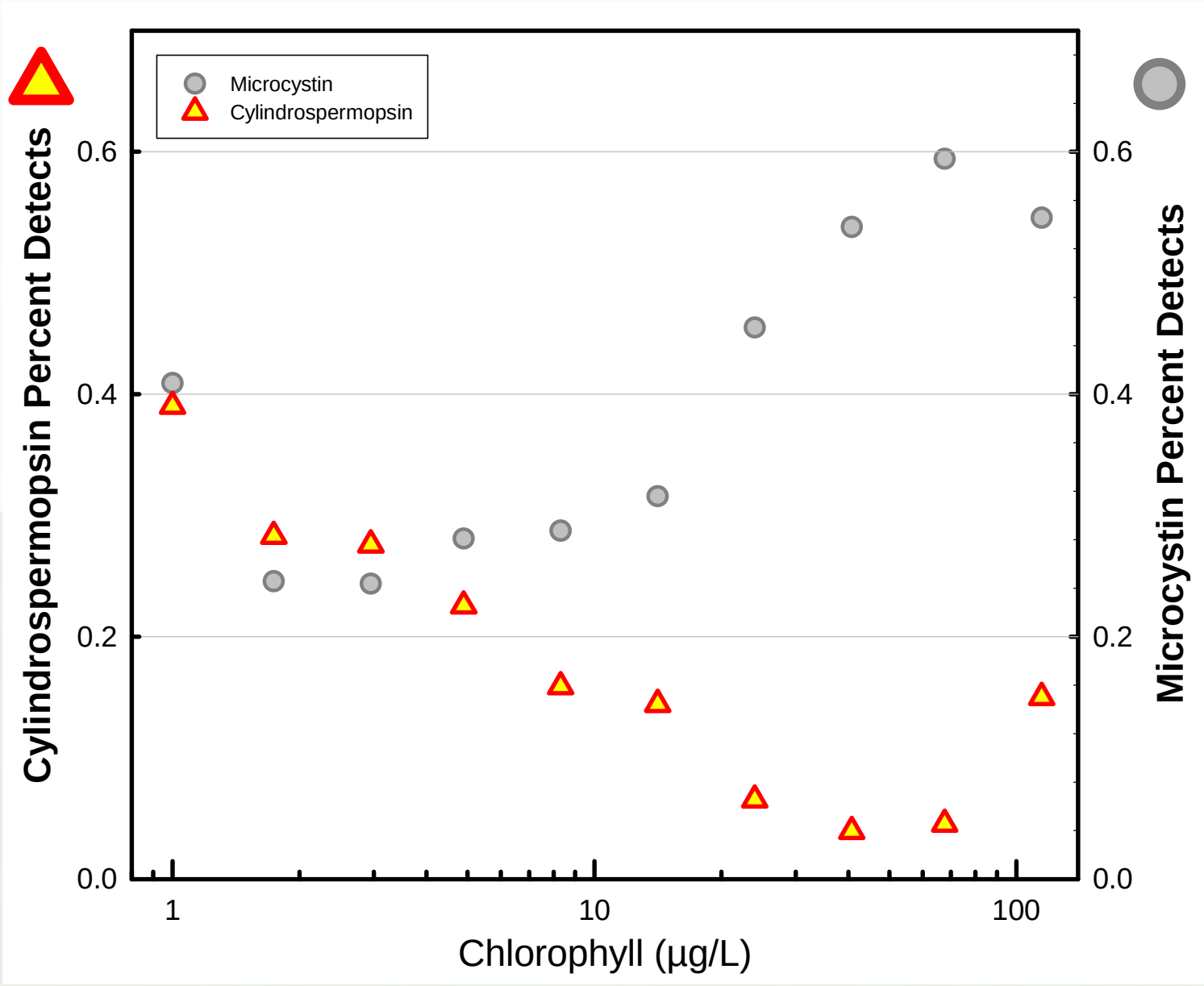
Chlorophyll data, 2017-2018

*Non-detects not shown



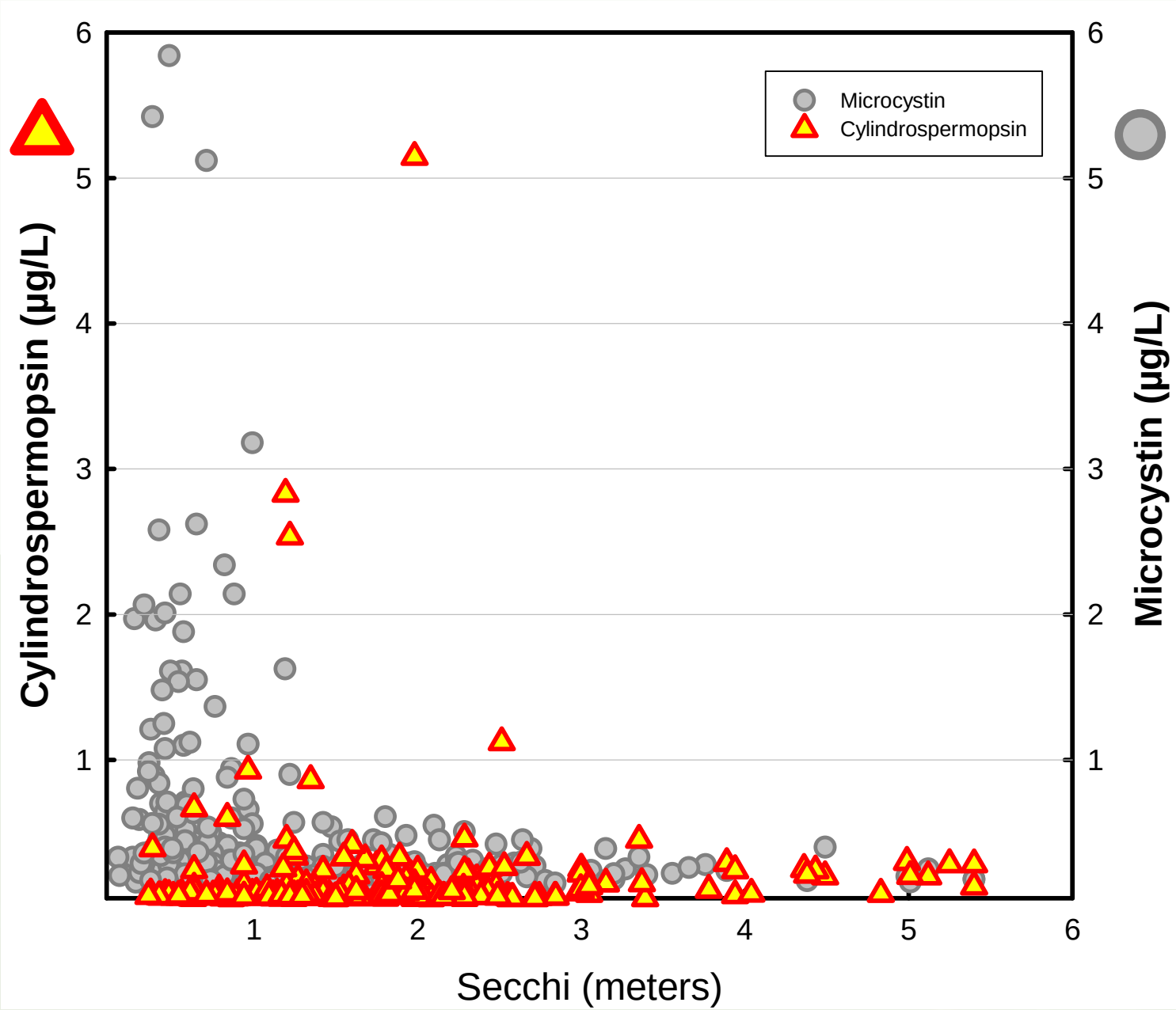
Binned Chlorophyll data, 2017 & 2018

Results from all lake data

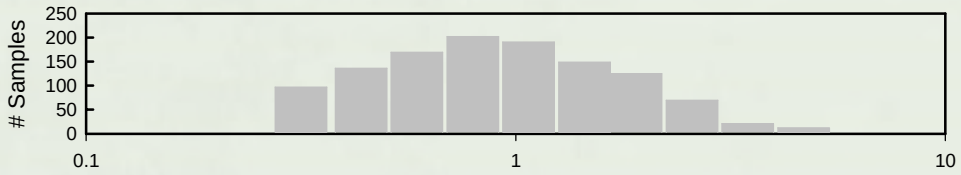


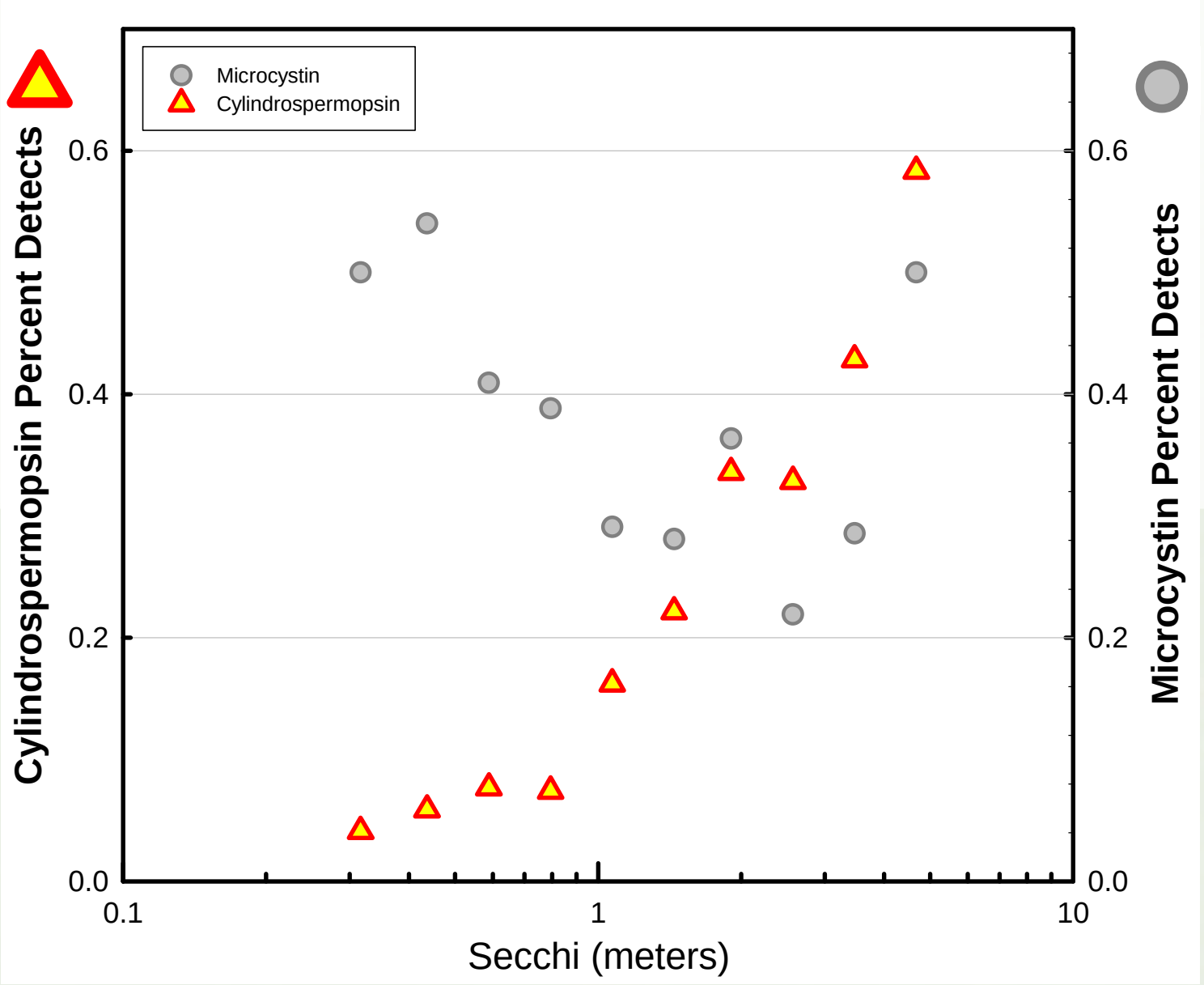
Secchi data, 2017-2018

*Non-detects not shown



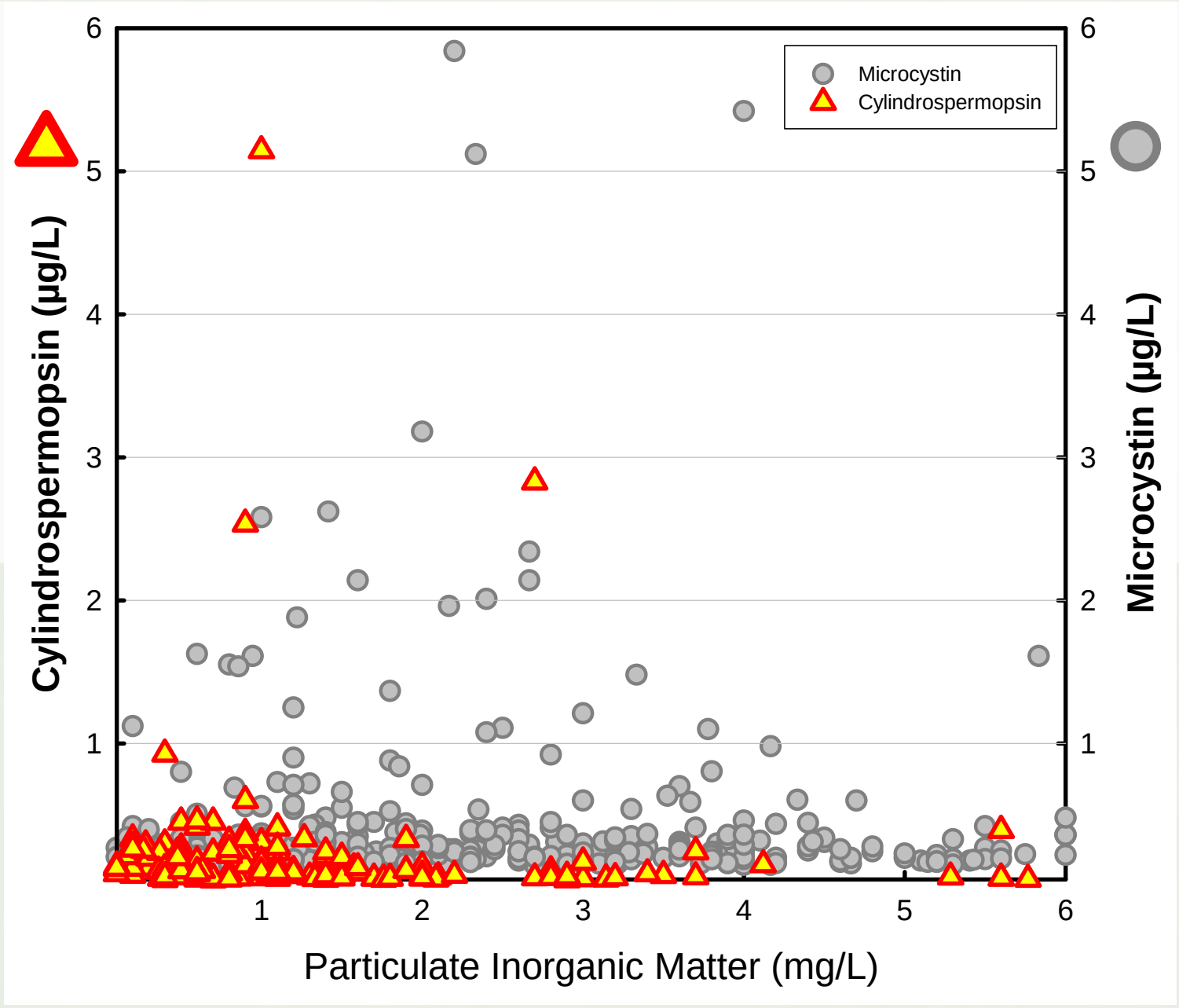
Binned Secchi data, 2017-2018





Particulate Inorganic Matter, 2017-2018

*Non-detects not shown



Binned Particulate Inorganic Matter data, 2017-2018